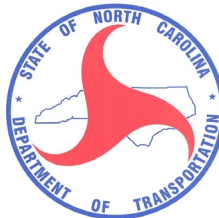


ANNUAL REPORT FOR 2000



**Long Creek Mitigation Site
Mecklenburg County
Project No. 8.U672204
TIP No. R-2248**



Prepared By:
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North Carolina Department of Transportation
December 2000

SUMMARY

The Long Creek Mitigation Site is located in Mecklenburg County and was constructed in 1996. In order to receive mitigation credit, the site must meet jurisdictional success criteria for both wetland hydrology and vegetation for three consecutive years; the following report details the monitoring activities during the 2000 growing season. The 2000 data represents results from the third year of hydrologic monitoring and the fourth year of vegetation monitoring.

Two new Infinity rain gauges were installed on the site April 29, 2000. Before that time, the Charlotte weather station data was utilized. It is anticipated that these gauges will provide more localized data than the previous rain gauges, however to verify to the accuracy of the rainfall gauges, the on-site rainfall data was compared to the Charlotte weather station throughout the year to identify any possible discrepancies.

In 1998, thirteen of the eighteen groundwater gauges met the hydrologic success criteria of saturation within 12 inches of the soil surface for more than 12.5% of the growing season. One year later, none of the gauges met the hydrologic success criteria. However, in 2000 nine of eighteen again met the success criteria. In addition, only 4 of 18 wells did not at least meet the 5% threshold for hydraulic success in 1998 and 2000. Trends are beginning to emerge that indicate which climatic conditions are necessary for success and which areas of the site are meeting the success criteria and which areas are not.

The vegetation monitoring indicated tree survival well above the required 320 trees per acre for the fourth straight year. Because of the overwhelming success of the planted vegetation, it is recommended that vegetation monitoring be discontinued. If any additional remediation is performed at some point in the future, then vegetation monitoring may be reinitiated to ensure the survival of the plants.

NCDOT will continue hydrologic monitoring until success criteria are met or enough information can be collected on the site that appropriate changes can be made to help in achieving success. Currently, NCDOT is coordinating efforts to evaluate any possibilities that could increase hydrologic input to the mitigation site. This is specifically valid in areas of the site, where hydrology is marginal or not present from year to year based on the groundwater data that is collected.

1.0 INTRODUCTION

1.1 Project Description

Located in Mecklenburg County, the Long Creek Mitigation Site encompasses approximately 156 acres. It is situated off of Beatties Ford Road (SR 2074) and will be bisected by the future I-485 (Figure 1). This project provides compensatory mitigation for wetland impacts due to sections of the proposed Charlotte Outer Loop.

The Long Creek Site is designed to restore a bottomland hardwood forest wetland. It was originally constructed in December of 1996, with the majority of the planting occurring in 1997. A five-acre portion, consisting of the former haul roads, was planted in early 1998. Groundwater, surface water, and rain gauges were installed in early 1998. 2000 is the third year of hydrologic monitoring and the fourth year of vegetation monitoring for the site.

1.2 Purpose

Monitoring of the Long Creek Site is required to demonstrate successful mitigation. The success of a wetland site is based predominantly on federal guidelines for wetland mitigation; these guidelines include minimum standards for hydrologic conditions and vegetation survival. Both hydrologic and vegetation monitoring is conducted throughout the growing season; success criteria must be met for three consecutive years. The following report details the results of the hydrologic and vegetation monitoring for 2000 at the Long Creek Mitigation Site.

1.3 Project History

| | |
|----------------------|---|
| December 1996 | Grading Construction |
| March 1997 | Site planted (except for approximately 5 ac. of haul roads) |
| September 1997 | Vegetation Monitoring (1 yr.) |
| October 1997 | Monitoring Gauges Installed |
| March 1998 | Haul Roads Planted |
| March- November 1998 | Hydrologic Monitoring |
| September 1998 | Vegetation Monitoring (2 yr) |
| March- November 1999 | Hydrologic Monitoring |
| September 1999 | Vegetation Monitoring (3 yr) |
| March- November 2000 | Hydrologic Monitoring |
| September 2000 | Vegetation Monitoring (4 yr) |

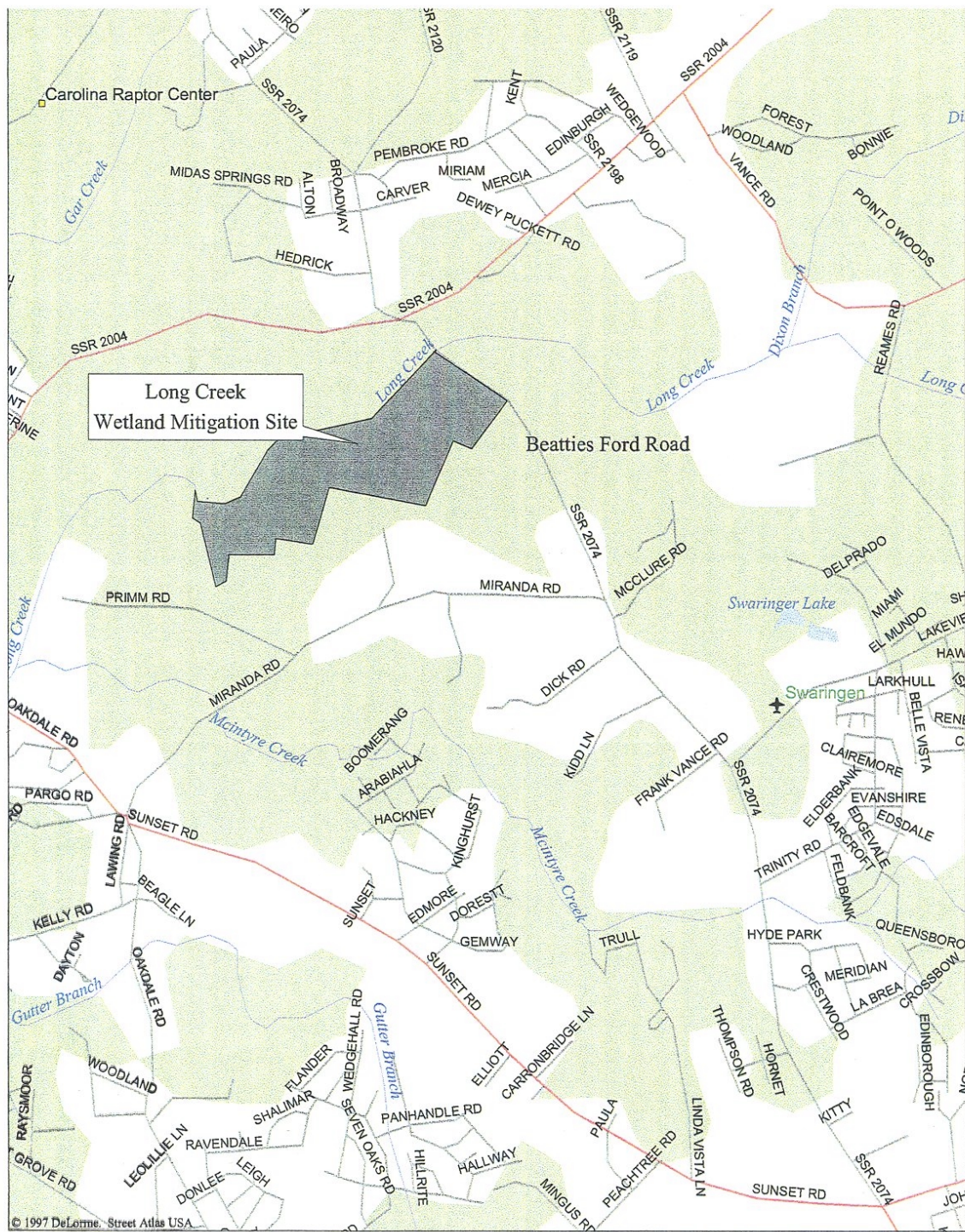


FIGURE 1
SITE LOCATION MAP

2.0 HYDROLOGY

2.1 Success Criteria

In accordance with federal guidelines for wetland mitigation, the success criteria for hydrology states that areas must be inundated or saturated (within 12 inches of the surface) by surface or groundwater for at least a consecutive 12.5% of the growing season. Areas inundated for less than 5% of the growing season are always classified as non-wetlands. Areas inundated between 5% and 12.5% of the growing season can be classified as wetlands depending upon such factors as the presence of wetland vegetation and hydric soils.

The growing season in Mecklenburg County begins March 22 and ends November 11, lasting 235 days. These dates correspond to a 50% probability that air temperatures will drop to 28F or lower after March 22 and before November 11.¹ Minimum wetland hydrology is required for at least 12.5% of this growing season; for Mecklenburg County, this 12.5% equals 29 consecutive days. Local climate must represent average conditions for the area in order for the hydrologic data to be considered successful.

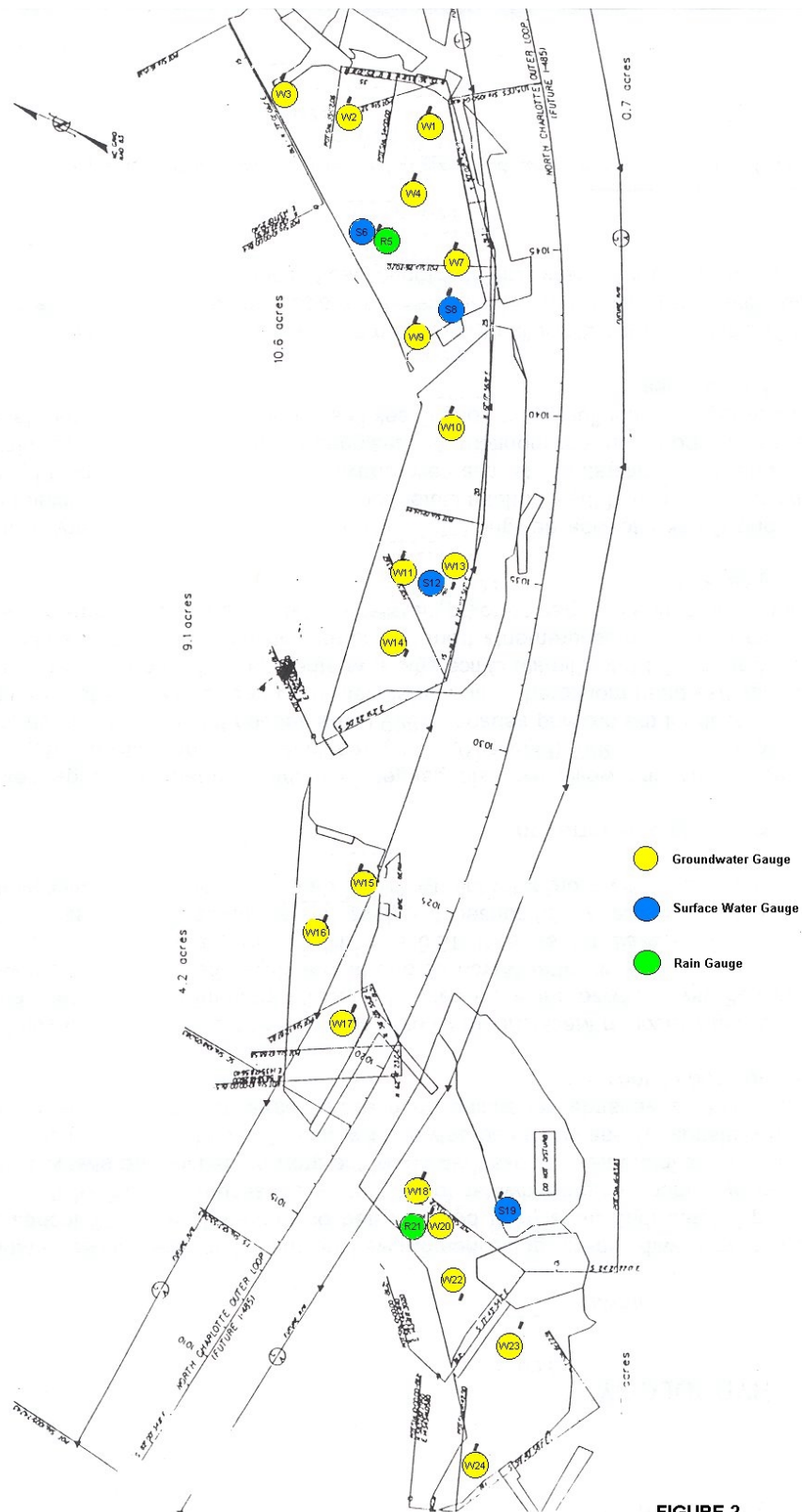
2.2 Hydrologic Description

Eighteen groundwater gauges, two rain gauges, and three surface water gauges were installed in October 1997 (Figure 2). Daily readings of the groundwater depth were taken throughout the growing season. 2000 is the third full growing season that the hydrology has been monitored. The rainfall data used to analyze the site groundwater data is from partially from the NC State Climate Office official weather station located in Charlotte and partially from the on-site rainfall gauges.

The Long Creek site was designed to function with rainfall as its primary hydrologic influence. A new section of the Charlotte Outer Loop is proposed for construction through the center of the mitigation site. Runoff from the proposed roadway section is anticipated to outlet into the mitigation site, which in turn will add hydrology to the site. Current monitoring is designed to show the influence of rainfall on site hydrology. The influence of Long Creek itself should be reflected in the data from the surface gauges.

In 1998, thirteen of the 22 groundwater gauges on the site met jurisdictional success criteria. Monthly rainfall totals for Charlotte in 1998 indicated average climate conditions. The site was initially considered a success, and monitoring was to continue. However, in 1999, none of the groundwater gauges met the jurisdictional success

¹ Natural Resources Conservation Service, Soil Survey of Mecklenburg County, North Carolina, p.61.



**FIGURE 2
GAUGE LOCATION MAP**

criteria and only six had hydrology for at least 5% of the growing season. While some of the failure can be linked to below normal rainfall for the months of February and March, such complete failure was obviously a concern.

2.3 Results of Hydrologic Monitoring

2.3.1 Site Data

The maximum number of consecutive days that the groundwater was within twelve inches of the surface was determined for each well. This number was converted into a percentage of the 235-day growing season. The results are presented in Table 1.

Appendix A contains a plot of the water depth for each monitoring well and surface gauge. Precipitation events are included on each graph as bars. These graphs show the reaction at each monitoring location of the groundwater level to specific rainfall events.

Table 1
HYDROLOGIC MONITORING RESULTS

| Monitoring Well | < 5% | 5% - 8% | 8% - 12.5% | > 12.5% | Actual % | Dates of Success |
|-----------------|------|---------|------------|---------|----------|------------------|
| LCW-1 | | ✓ | | | 7.2 | Apr 14- Apr. 30 |
| LCW-2 | | | ✓ | | 8.5 | Apr 14- May 3 |
| LCW-3 | | | | ✓ | 21.3 | Mar 22- May 10 |
| LCW-4 | | | | ✓ | 18.7 | Mar 22- May 4 |
| LCW-7 | | | ✓ | | 9.4 | Mar 22- Apr 12 |
| LCW-9 | ✓ | | | | 2.1 | Apr 15- Apr 19 |
| LCW-10 | | ✓ | | | 7.7 | Apr 14- May 1 |
| LCW-11 | | | | ✓ | 18.7 | Mar 22- May 4 |
| LCW-13 | | | | ✓ | 20.0 | Mar 22- May 7 |
| LCW-14 | | | | ✓ | 19.1 | Mar 22- May 5 |
| LCW-15 | | | | ✓ | 19.6 | Mar 22- May 6 |
| LCW-16 | ✓ | | | | 3.4 | Apr 15- Apr 22 |
| LCW-17 | | | | ✓ | 19.6 | Mar 22- May 6 |
| LCW-18 | ✓ | | | | 4.3 | Mar 22- Mar 31 |
| LCW-20 | ✓ | | | | 0.0 | |
| LCW-22 | | | | ✓ | 19.6 | Mar 22- May 6 |
| LCW-23 | | | | ✓ | 18.7 | Mar 22- May 4 |
| LCW-24 | | | ✓ | | 11.1 | Apr 10- May 5 |

The year 2000 data is very similar to the 1998 data. When comparing these two data sets, some trends are starting to emerge. First, most of the groundwater gauges that failed to achieve hydrology for 5% of the growing in 1998 also failed in 2000. Accordingly, every gauge that achieved greater than 12.5% hydrologic success in 2000

also achieved it in 1998. Secondly, the only time of the year that hydrology is met on this site is during the beginning of the growing season. This helps explain the failure of 1999 when an unusually dry end of the 1998 and beginning of the 1999 season caused the groundwater on the site to be below the 12 inch threshold to begin the growing season. Despite a fairly wet April, the site never recovered.

The placement of the groundwater gauges and a graphical representation of the hydrologic monitoring results are provided in Figure 3.

Specific monitoring well problems: A number of data sets were lost due to dead batteries, specifically groundwater gauges 1, 2, 16, 18, 20, and 24. These are noted on the graphs in Appendix A.

However, relying on the supposition that the critical period of monitoring is the beginning of the growing season, only gauges 1 and 24 had their hydrologic success effected, since the lost data was the first 17 days of the growing season. For gauge 24, based on past performance and the surrounding wells, it is reasonable to assume that the first 17 days would have indicated groundwater within 12 inches of the ground surface. Based on this assumption, gauge 24 would have met the 12.5% success criteria. The inferences one can draw on gauge 1 are not as defined, but may become so with continued monitoring.

2.3.2 Climatic Data

Figure 4 is a comparison of 2000 monthly rainfall to historical precipitation for the Charlotte area. Rainfall data was recorded by averaging the measurements of the two rain gauges at the site. Rainfall data from the Charlotte weather station was substituted from March 22 through April 28, before the rain gauges were installed, and from August 7 through September 6, when the gauges failed. The rainfall amounts were compared to the historical 30-70 percentile trends for the area. It is assumed that if the 2000 rainfall totals, represented by bars, fall between the average precipitation values for each month, then the local climate was experiencing average conditions for that particular region.

2.4 Conclusions

In 1998, thirteen of the eighteen groundwater gauges met the hydrologic success criteria. One year later, none of the gauges indicated saturation for more than 12.5% of the growing season. However, in 2000 nine of eighteen met the hydrologic success criteria. More importantly, trends are beginning to emerge that indicate which climatic conditions are necessary for success and which areas of the site are meeting the success criteria and which areas are not. DOT will continue monitoring the site and the development of these trends.

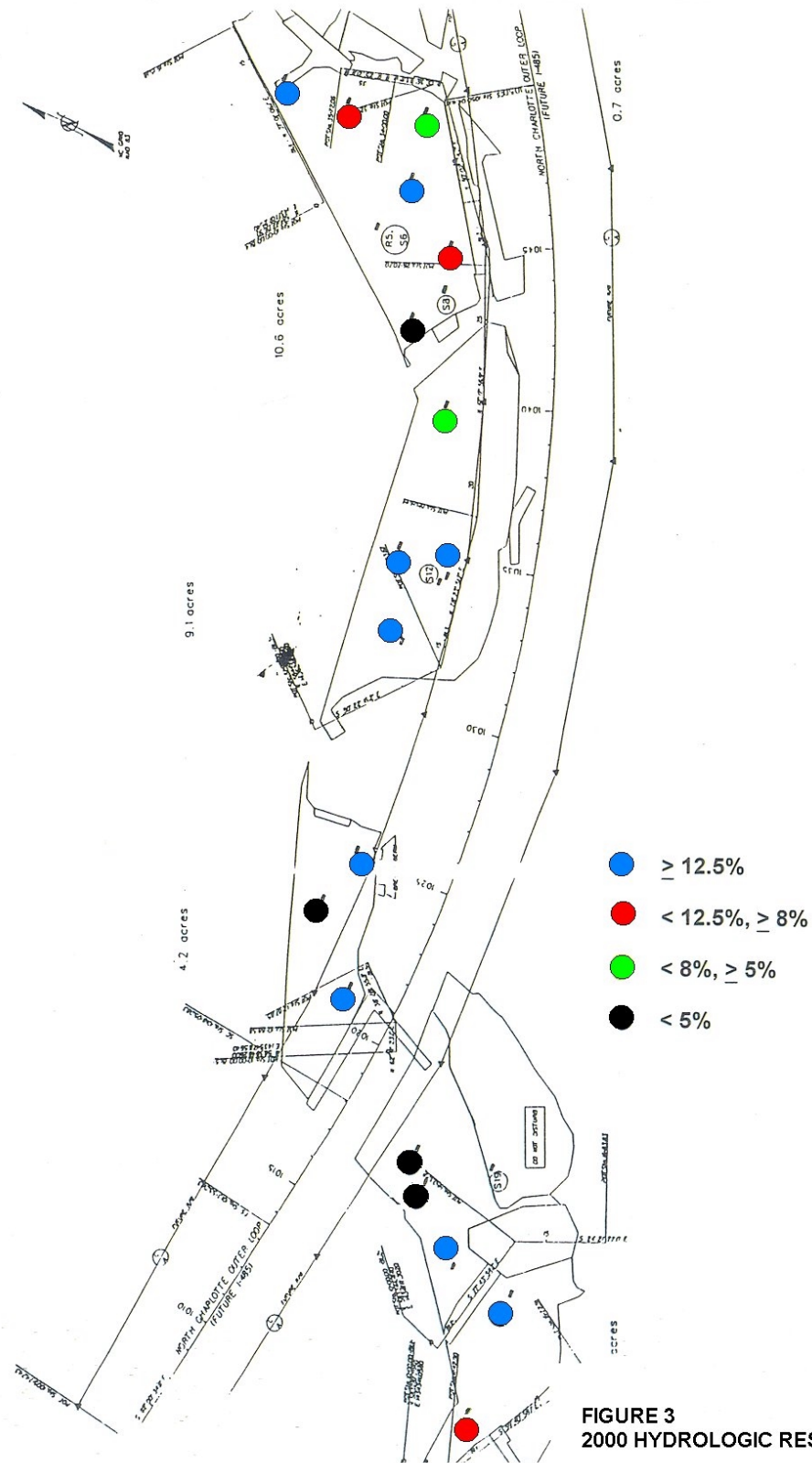
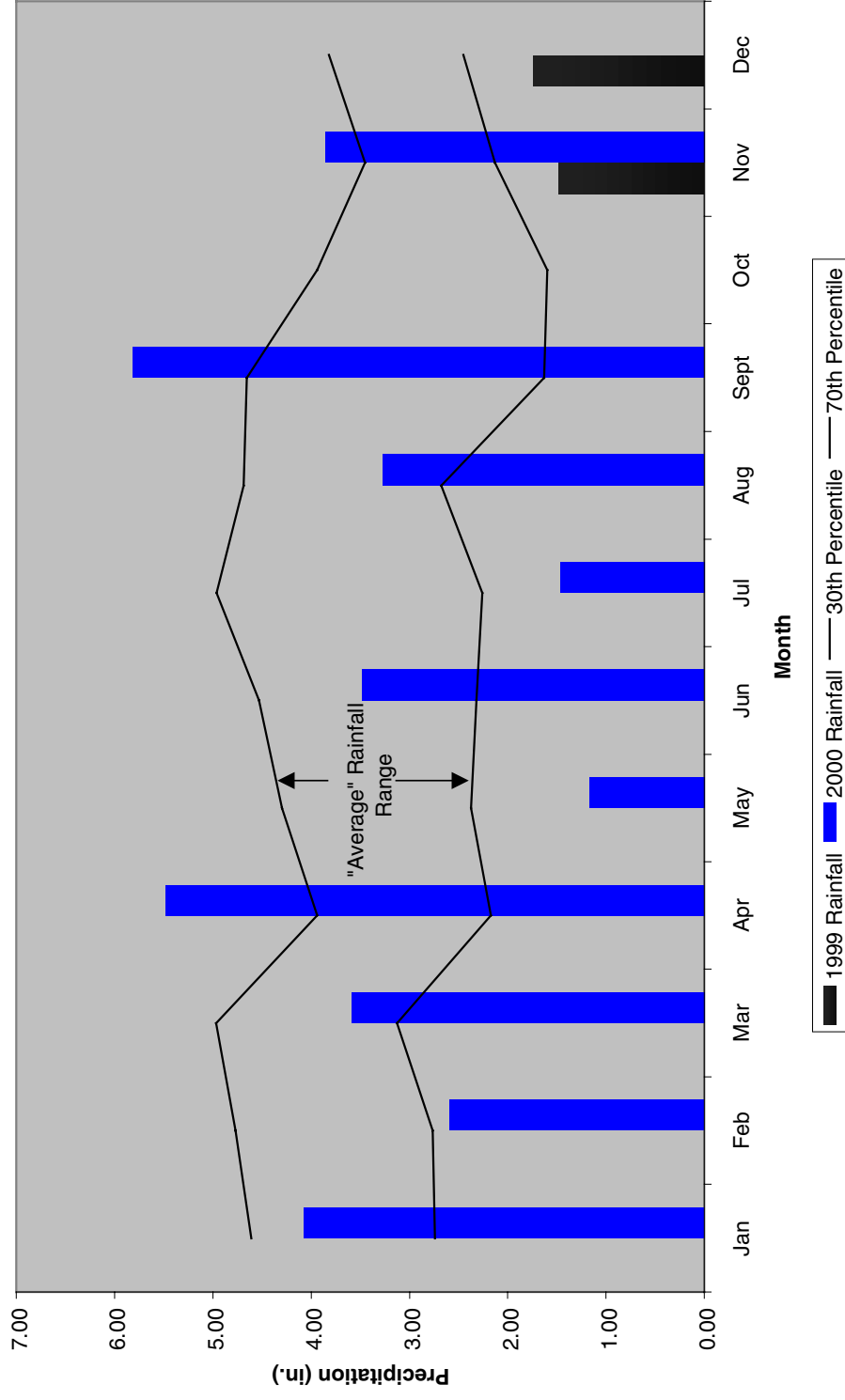


FIGURE 3
2000 HYDROLOGIC RESULTS

Figure 4.
Long Creek 30-70 Percentile Graph
Charlotte, NC



3.0 VEGETATION: LONG CREEK MITIGATION SITE (YEAR 4 OF 3)

3.1 Success Criteria

Success Criteria states that there must be a minimum mean density of 320 trees per acre of approved target species surviving for at least three years.

3.2 Description of Species

The following tree species were planted in the Wetland Restoration Area:

Fraxinus pennsylvanica, Green Ash

Fraxinus caroliniana, Carolina Ash

Betula nigra, River Birch

Quercus phellos, Willow Oak

Liriodendron tulipifera, Tulip Poplar

Quercus michauxii, Swamp Chestnut Oak

Quercus falcata var. pagodaefolia, Cherrybark Oak

Ulmus americana, American Elm

3.3 Results of Vegetation Monitoring

| Plot # (Type) | Green Ash | Carolina Ash | Cherrybark Oak | Swp Chestnut Oak | American Elm | Tulip Poplar | River Birch | Willow Oak | Total (3 year) | Total (at planting) | Density (Tree/Acre) |
|------------------------|-----------|--------------|----------------|------------------|--------------|--------------|-------------|------------|----------------|---------------------|---------------------|
| 1(BLH) | 11 | 1 | 4 | 6 | | | 1 | 8 | 31 | 35 | 602 |
| 2(BLH) | 9 | 1 | 10 | 5 | | | 2 | 8 | 35 | 35 | 680 |
| 3(BLH) | 9 | 1 | | 13 | | | 10 | 2 | 35 | 35 | 680 |
| 4(BLH) | 12 | 9 | 2 | | 6 | | 3 | 3 | 35 | 35 | 680 |
| 5(BLH) | 7 | 1 | 11 | 1 | 7 | 2 | 4 | 2 | 35 | 35 | 680 |
| 6(BLH) | 11 | 1 | 7 | 1 | 9 | 2 | | 4 | 35 | 35 | 680 |
| AVERAGE DENSITY | | | | | | | | | | | 667 |

To determine tree density, 50' x 50' plots are installed immediately following planting. The actual number of planted trees which occur within the plot are counted. This number is equated to the number within each plot, which represents 680 trees per acre (average). The survival monitoring number is compared to the planted number to obtain survival percentage. This percentage is applied to the 680 trees per acre to obtain an estimated tree per acre for the site. (Density = monitoring count / planted trees x 680)

Site Notes: Other species noted: lespedeza, golden rod, ragweed, cotton weed, red maple, sweetgum, dense briars, sycamore, juncus, volunteer green ash, volunteer red cedar, grasses, button bush, broomsedge, water oak and hickory.

3.4 Conclusions

Approximately 37 acres of this site was planted in bottomland hardwoods in March, 1997. The remaining 5 acres of the site was planted in March 1998. There were 6 vegetation monitoring plots established throughout the planting areas. Based on the results of the stem counts for the monitoring period, we obtained an average tree density of 667 trees per acre. This average is above the minimum success criteria of 320 trees/ acre.

4.0 OVERALL CONCLUSIONS/ RECOMMENDATIONS

Four years of vegetation monitoring has shown that the trees planted in 1997 are surviving. NCDOT would propose discontinuing the vegetation monitoring for the site. NCDOT realizes that if any changes are made which would affect site hydrology, the vegetation would need to be monitored again to ensure there were no damaging effects to the plants.

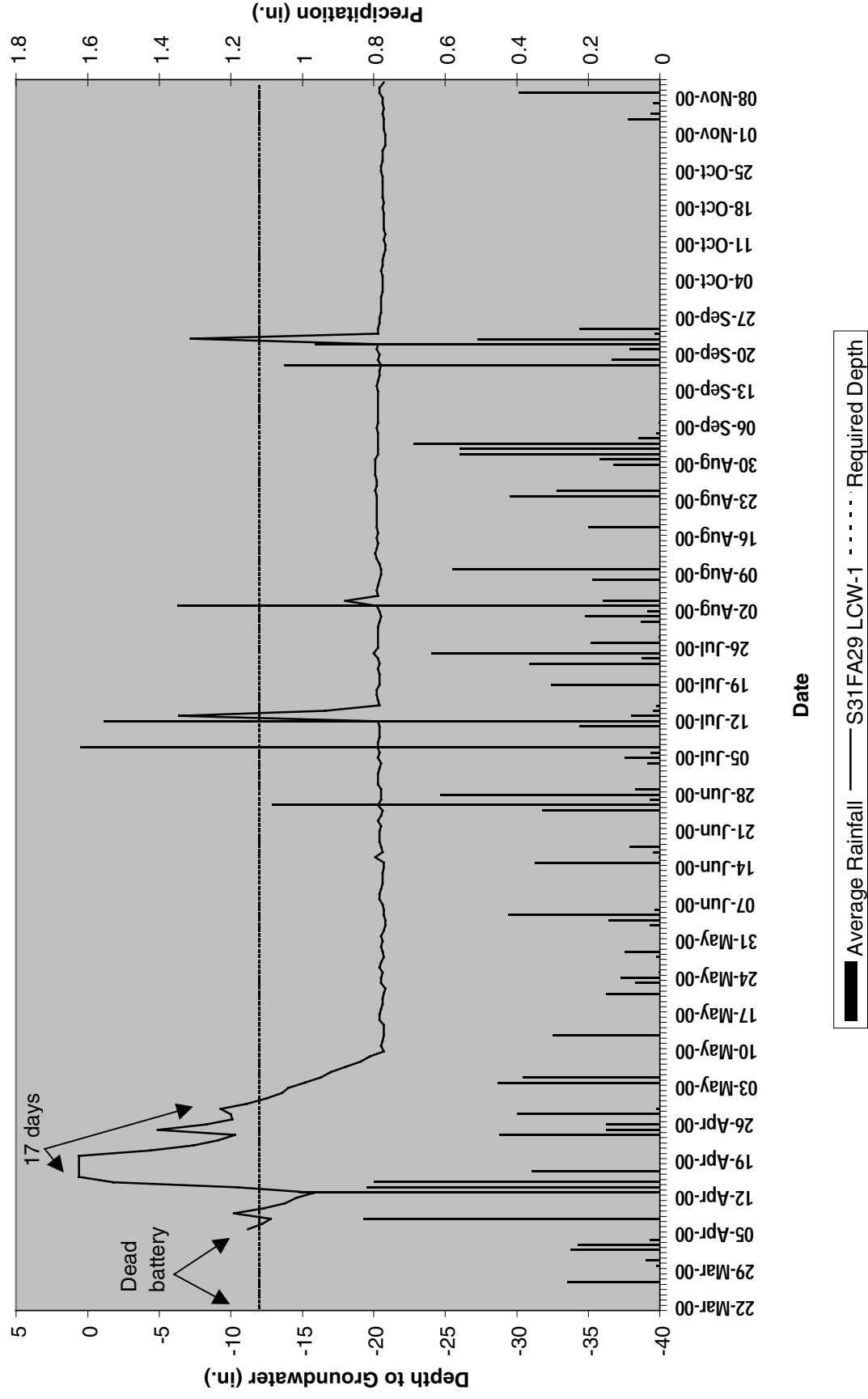
Because hydrologic monitoring has not met success criteria, monitoring of groundwater levels will continue. It is anticipated that average climate conditions would yield the site a greater chance for success. As was previously mentioned, additional hydrologic input will be initiated upon completion of the new roadway section through the center of the mitigation site.

If the site does not meet hydrologic success, NCDOT will consult with resource agencies in order to diagnose the problems and to find a workable solution.

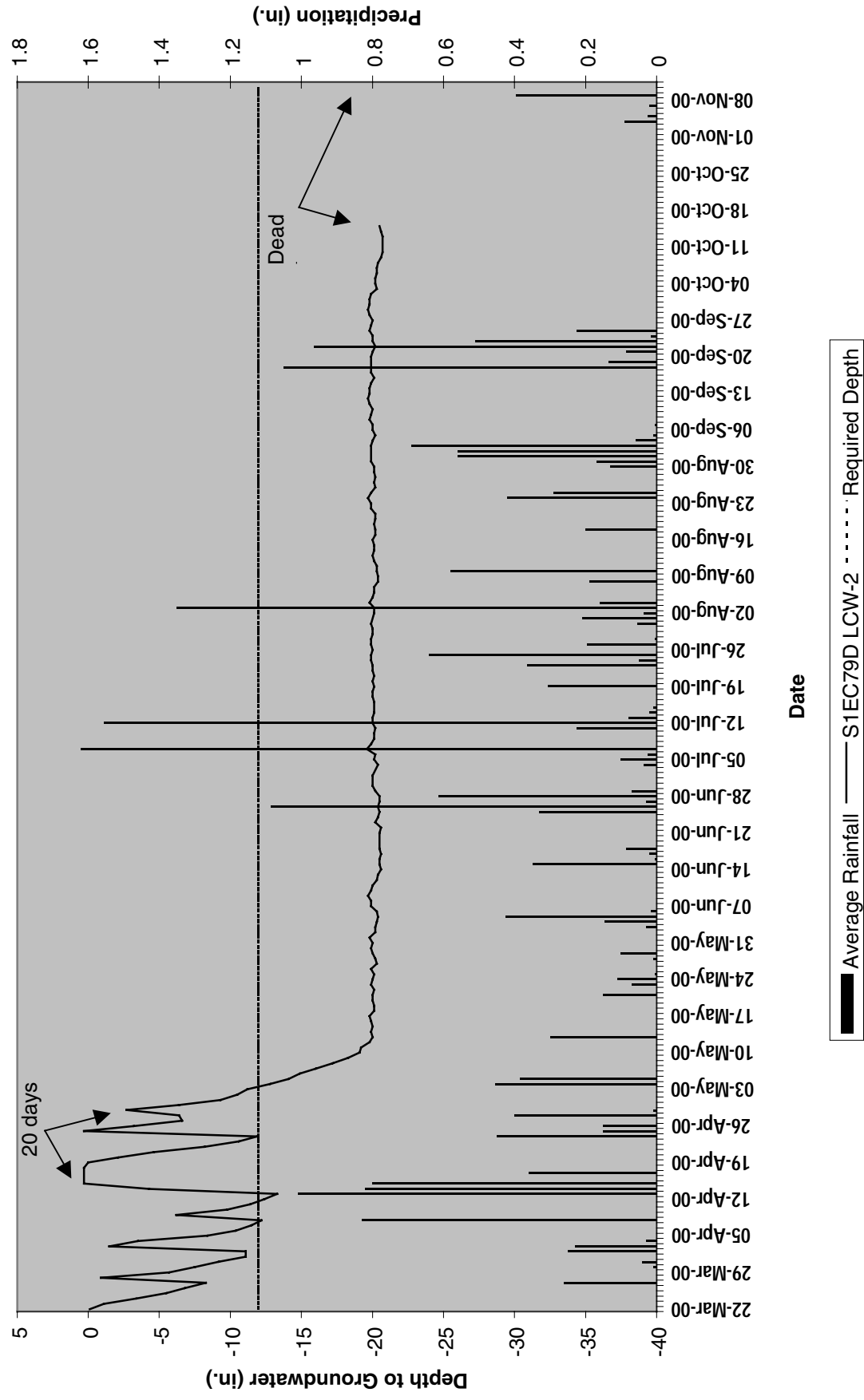
APPENDIX A

DEPTH TO GROUNDWATER PLOTS

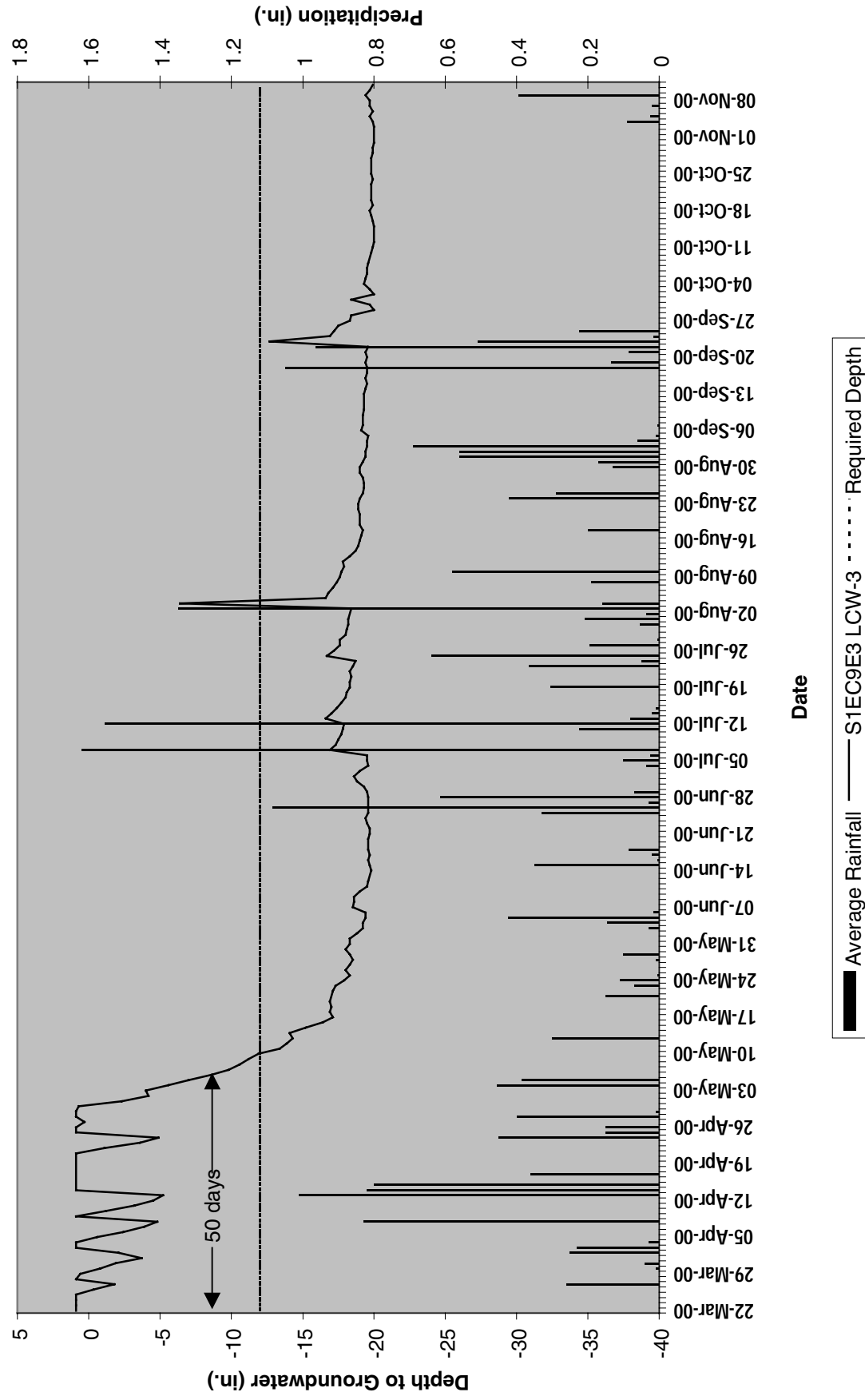
Long Creek LCW-1



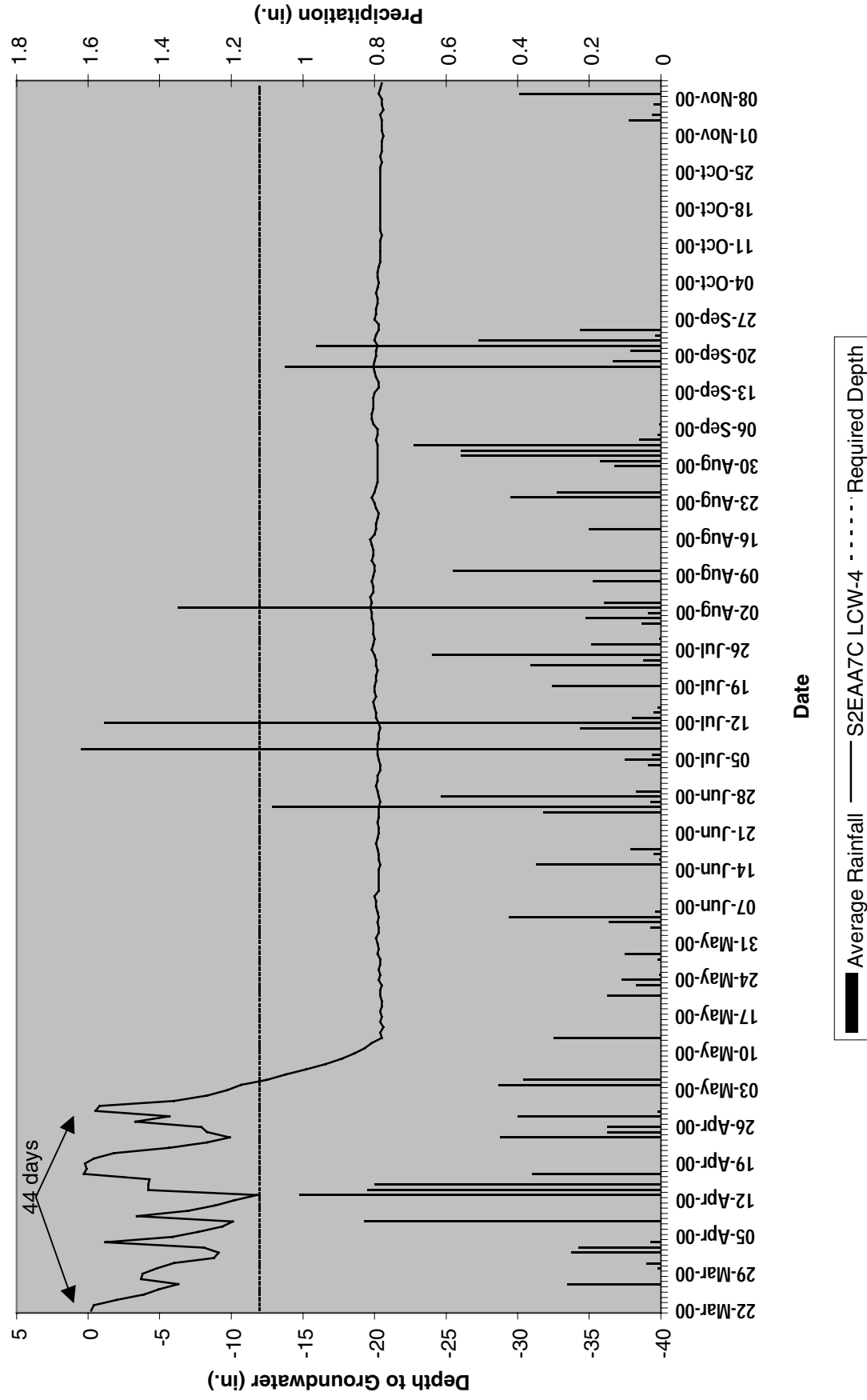
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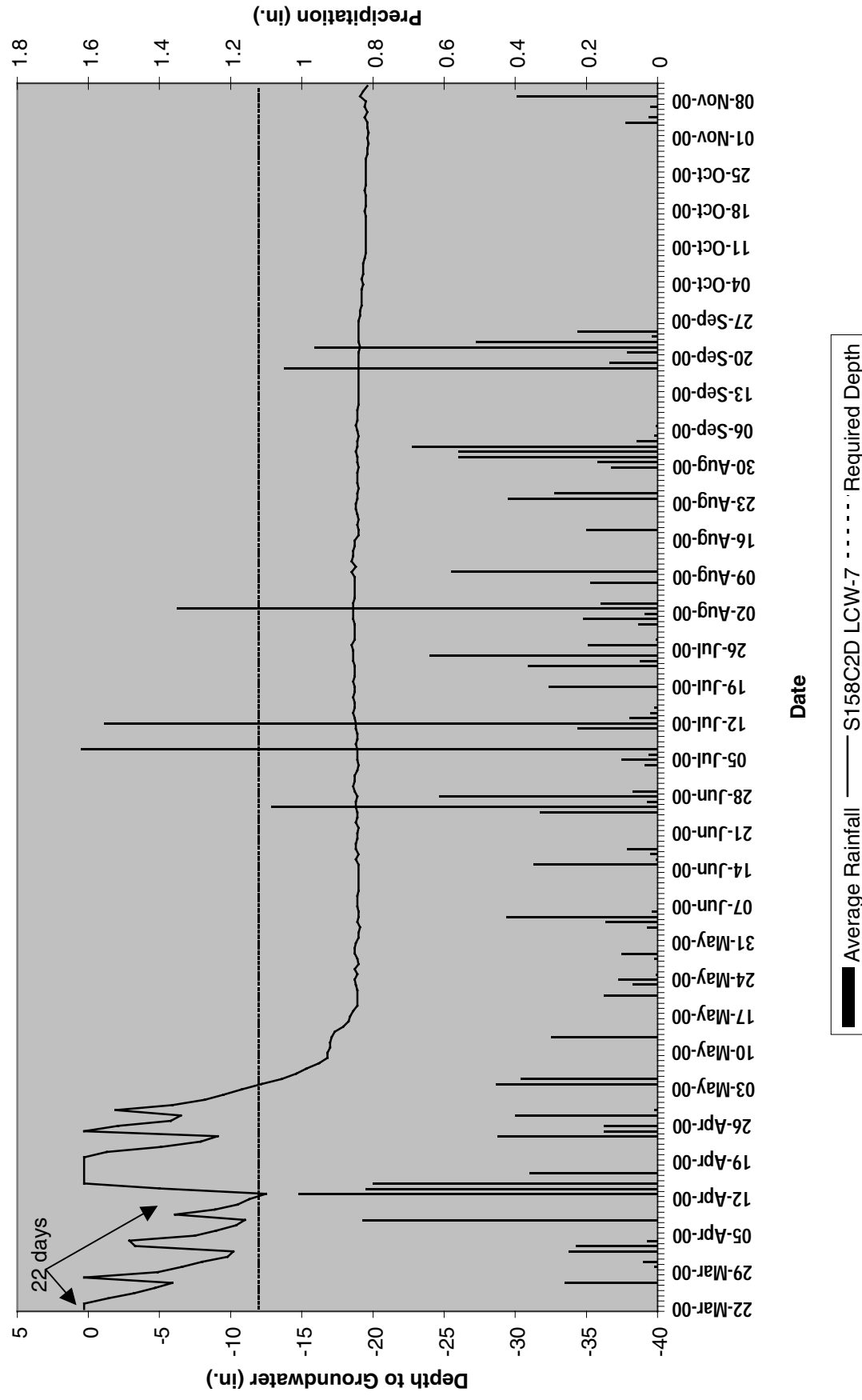
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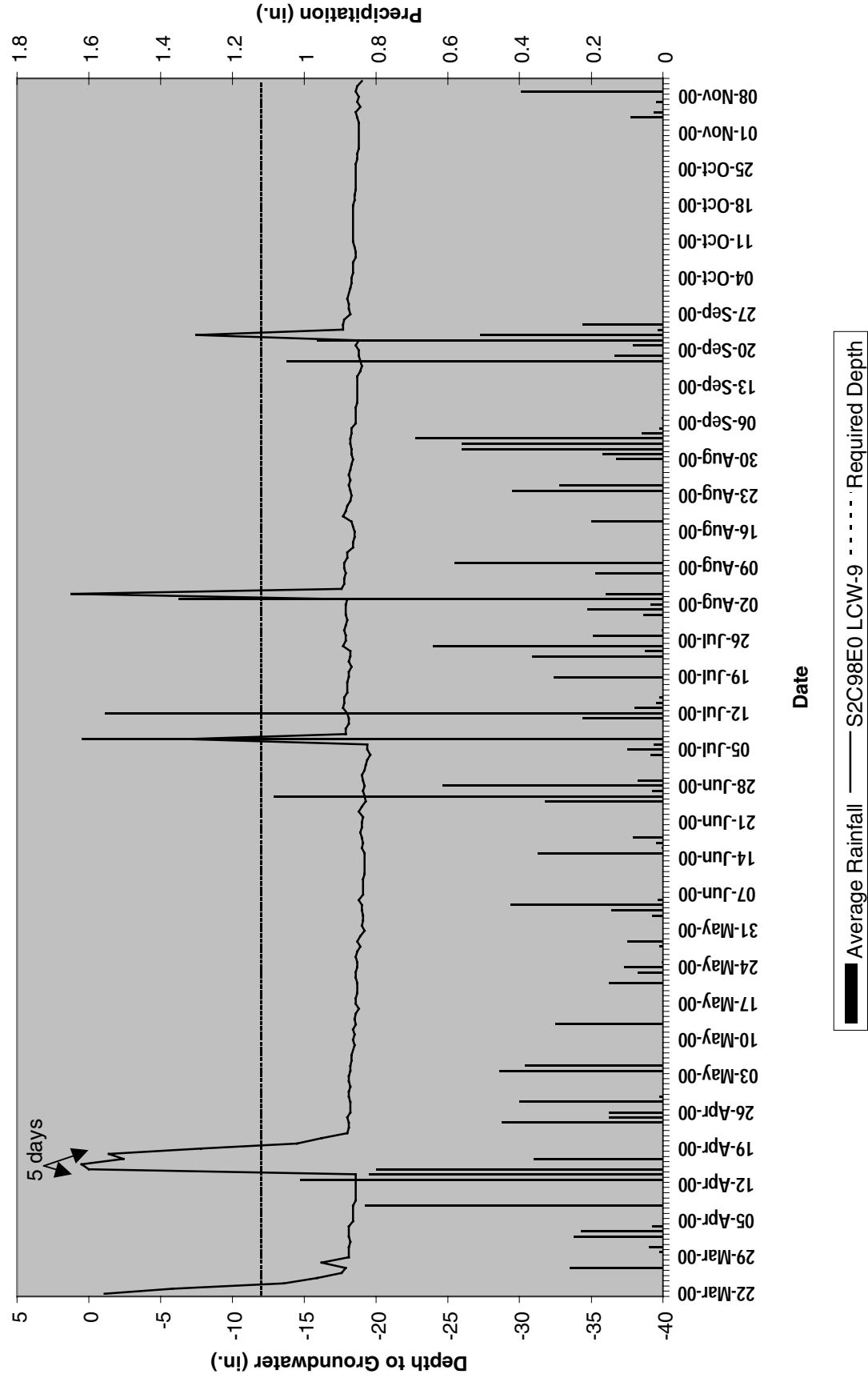
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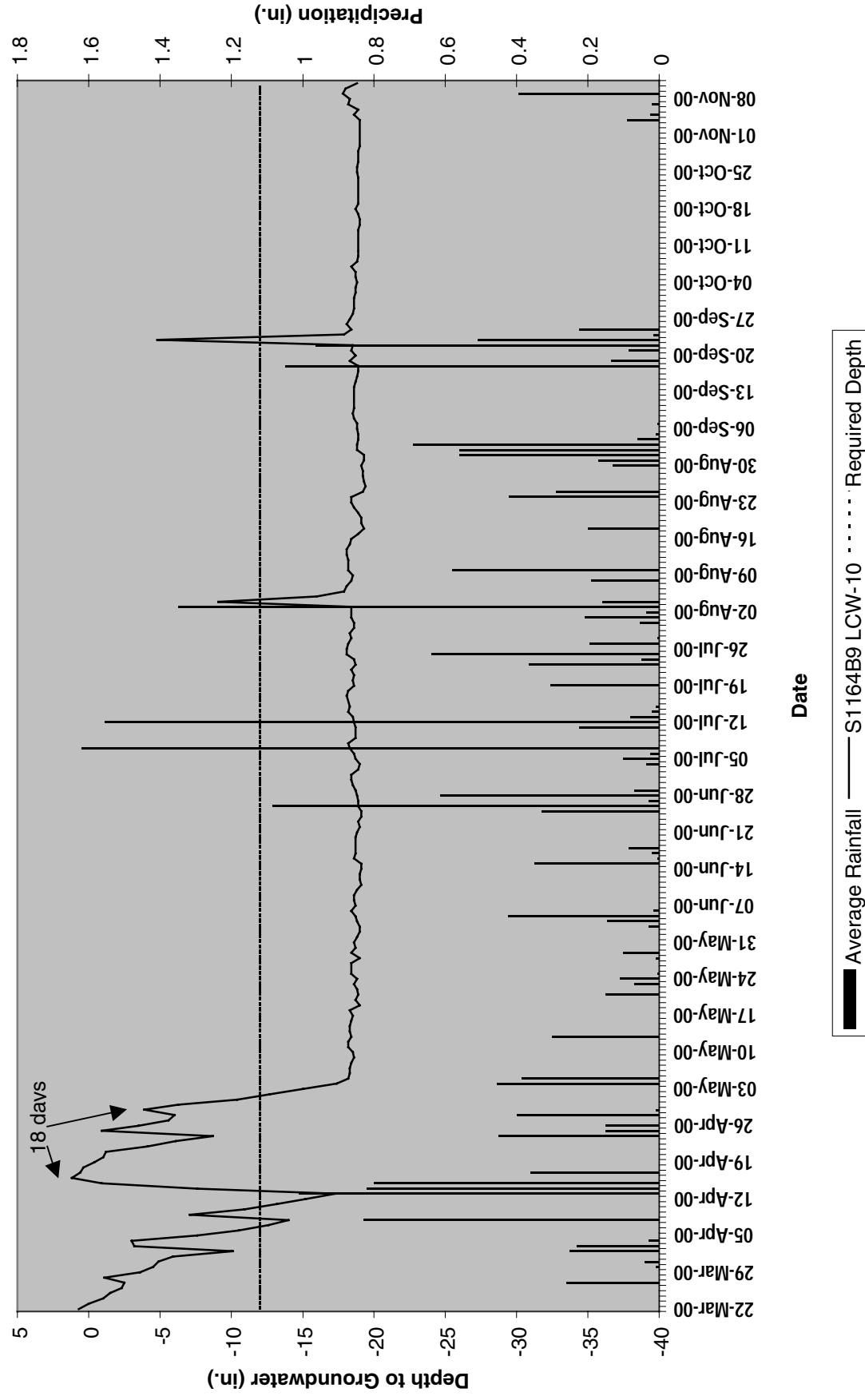
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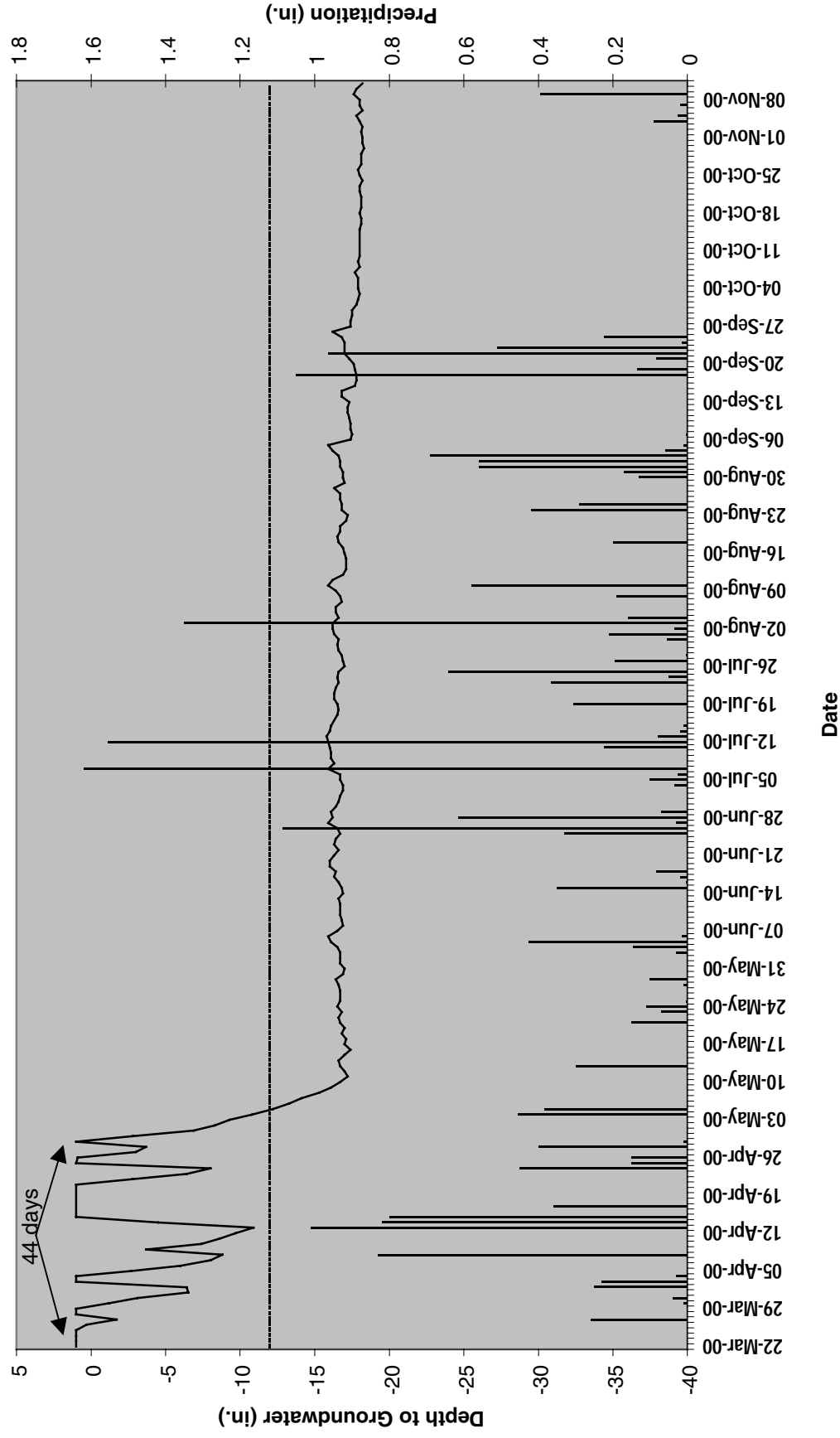
Long Creek LCW-9



Long Creek LCW-10

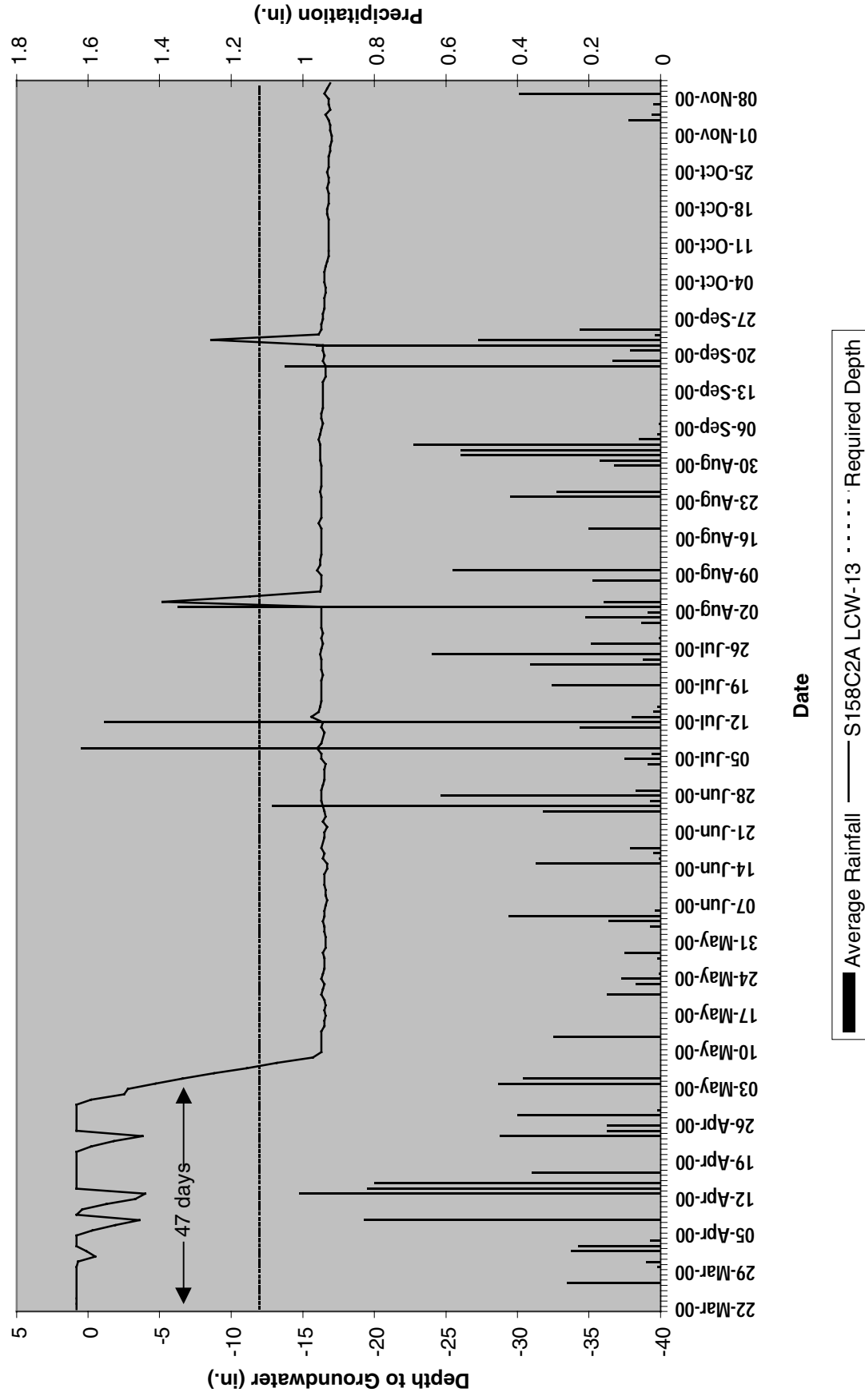


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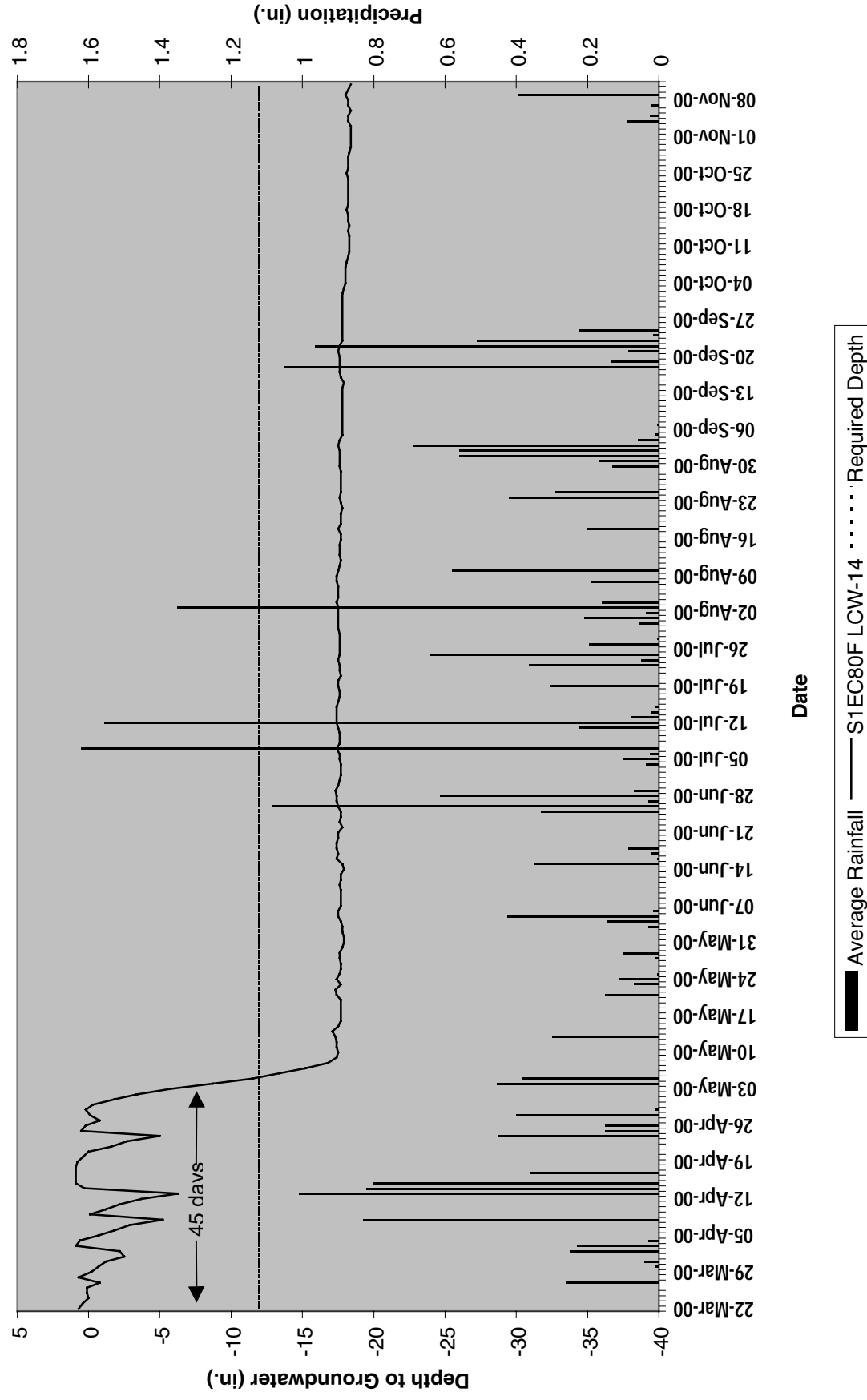


Average Rainfall
 S1EC9F7 LCW-11
 Required Depth

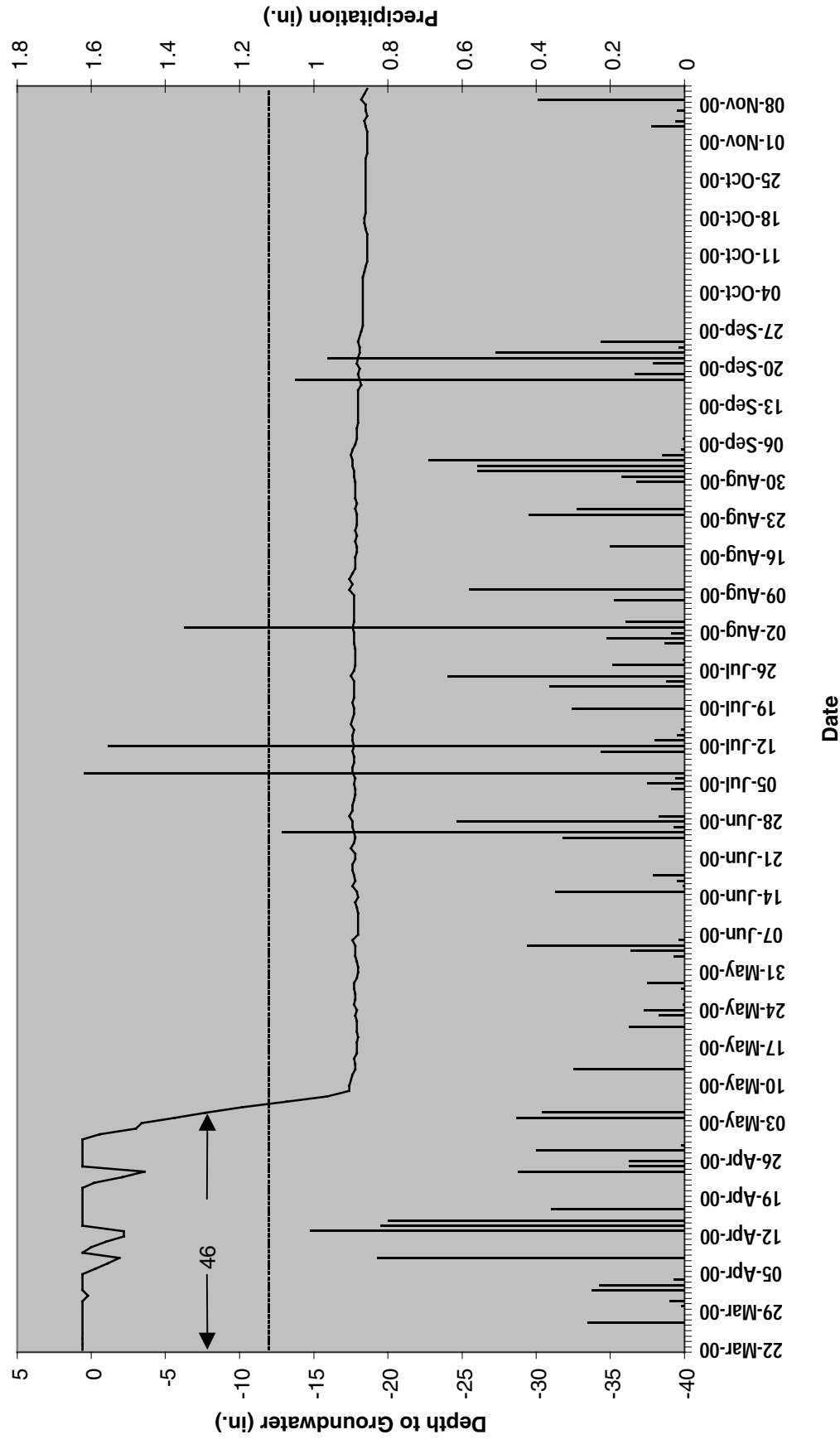
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Long Creek LCW-14

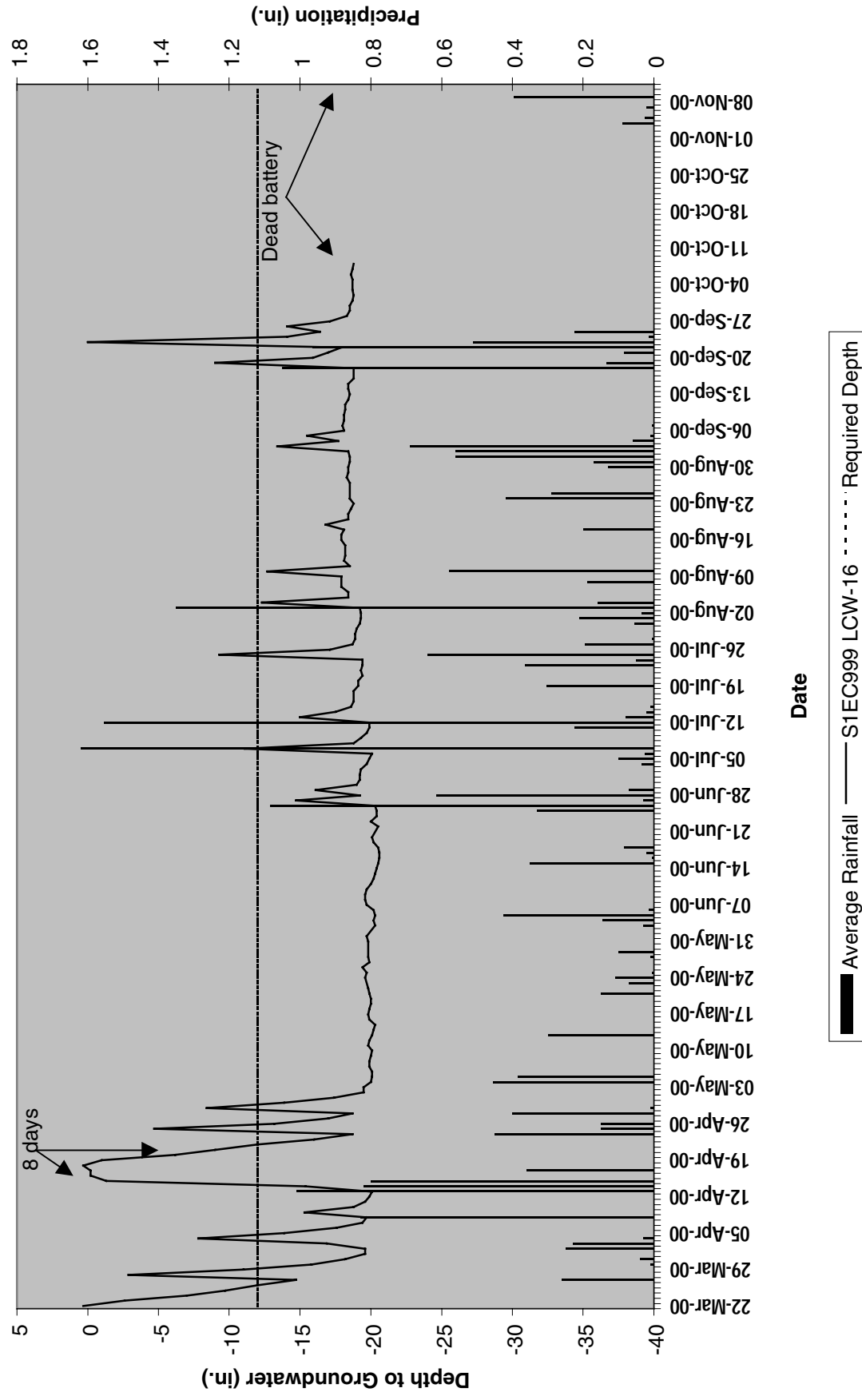


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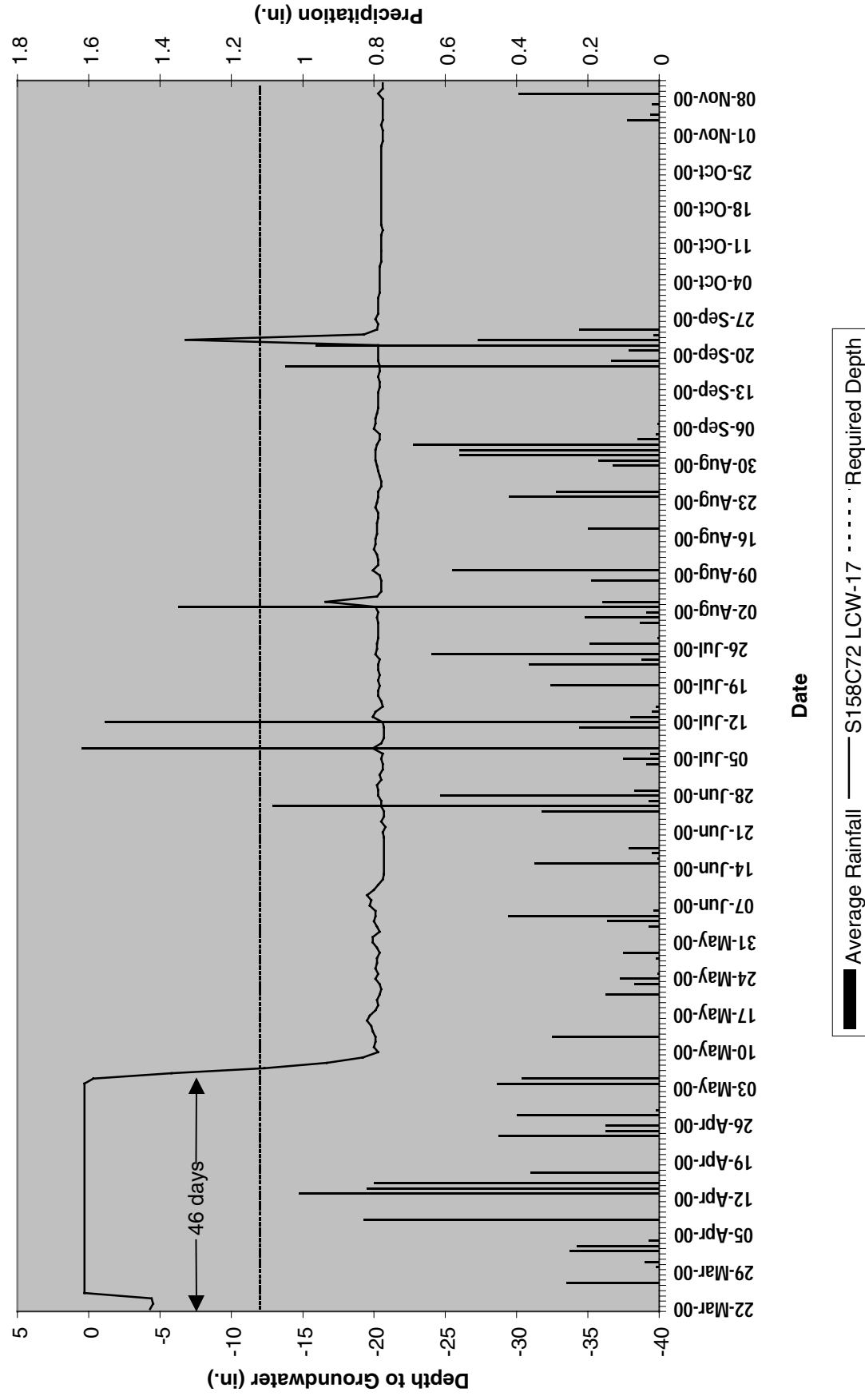


Average Rainfall
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 Required Depth

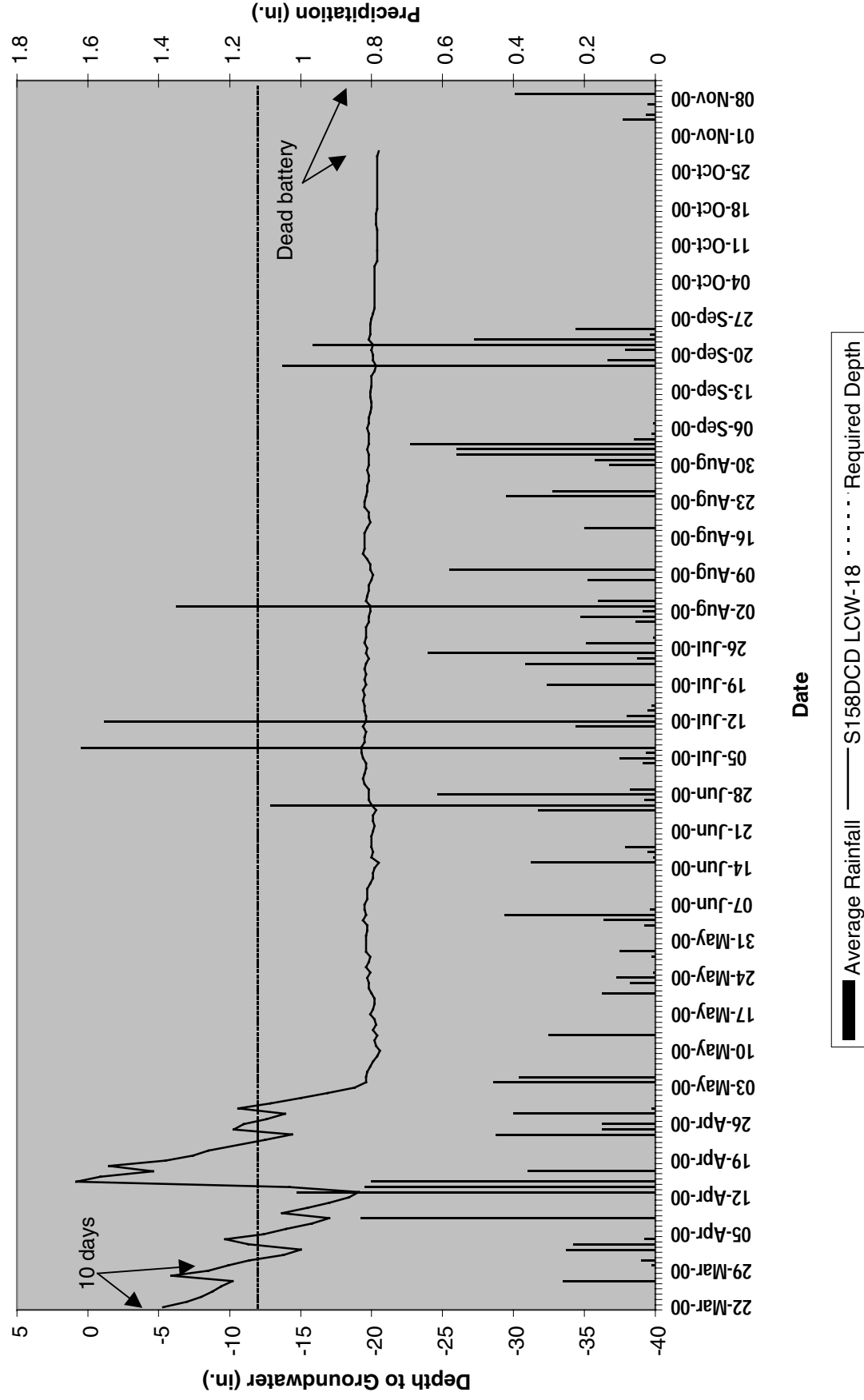
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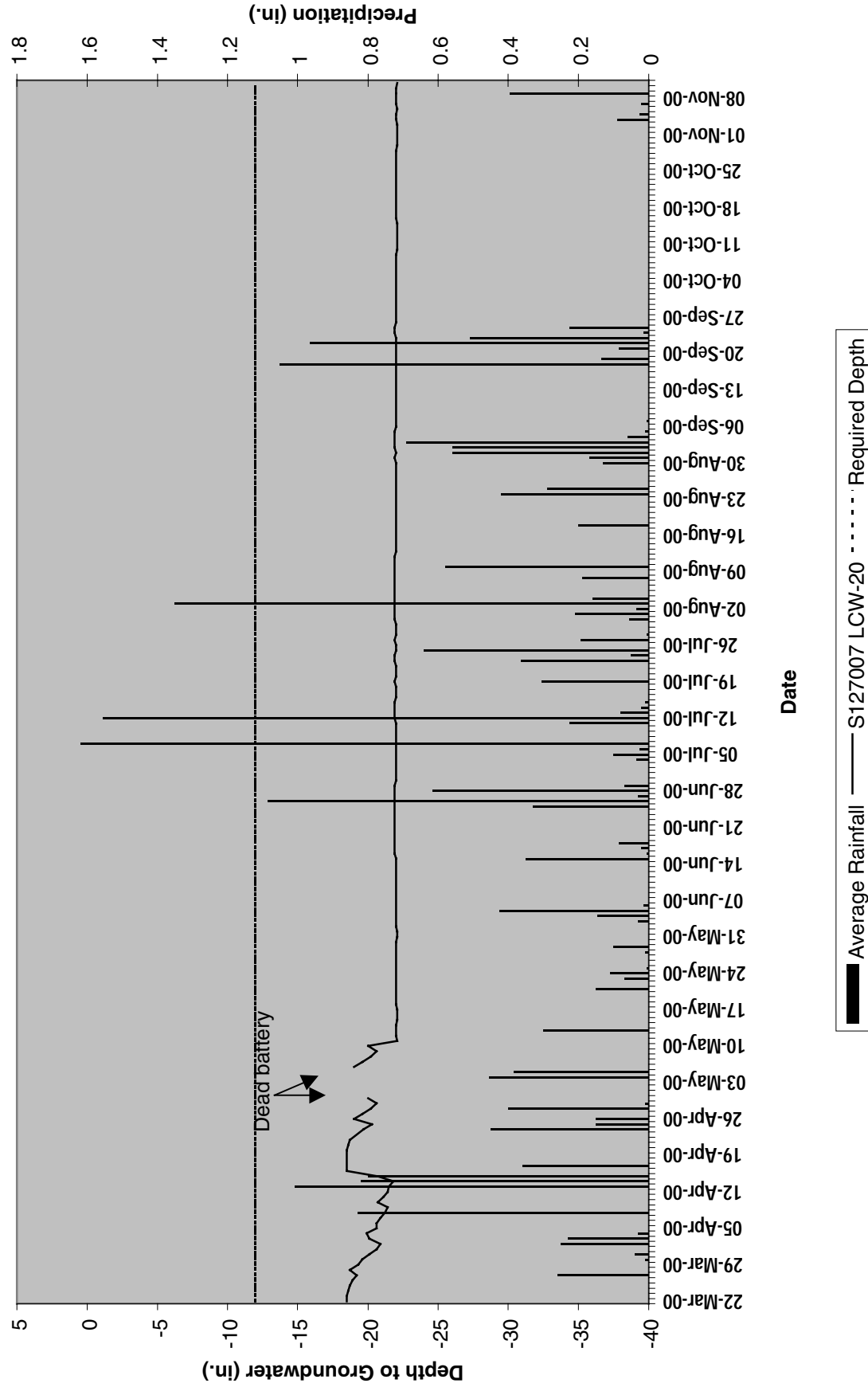
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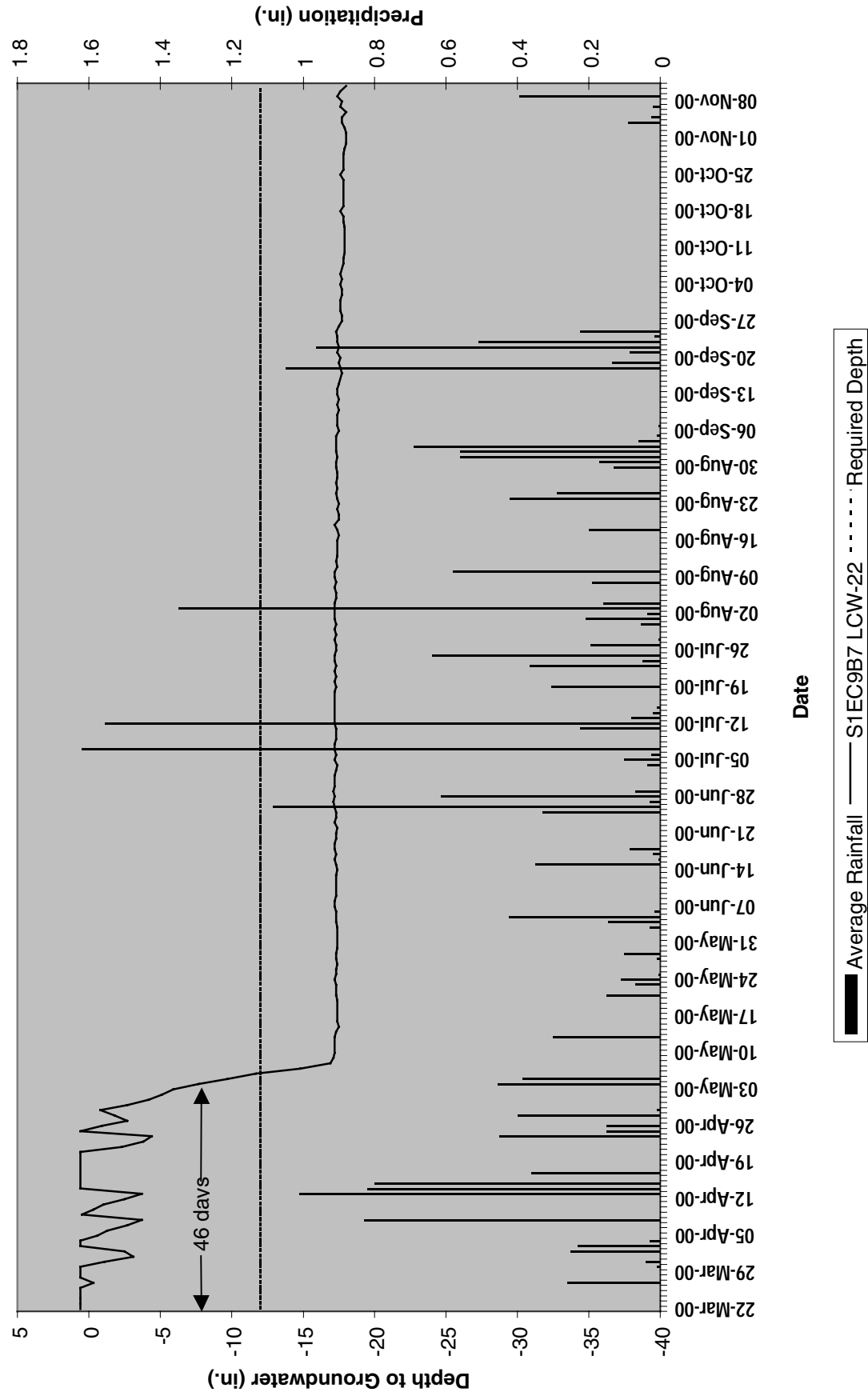
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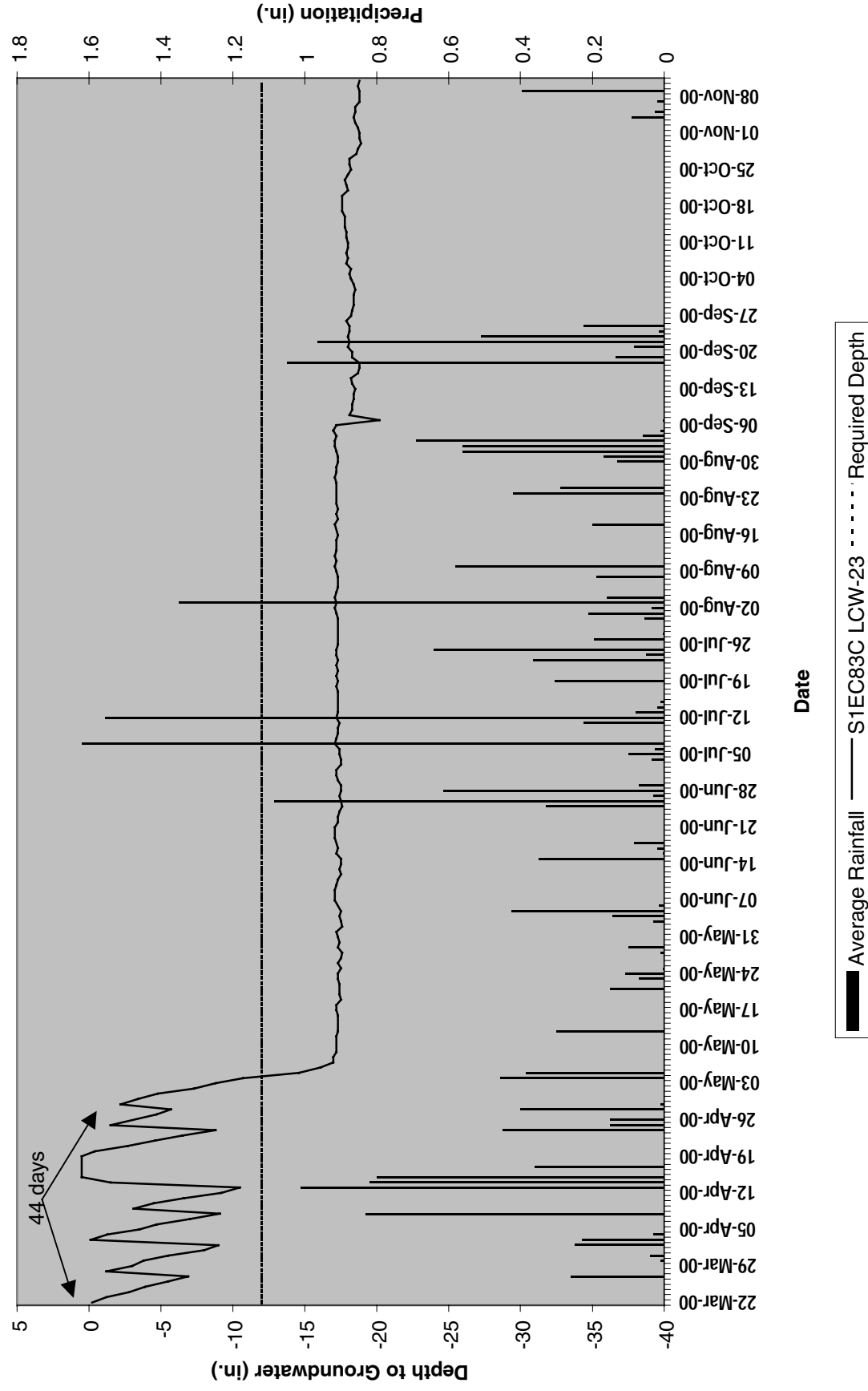
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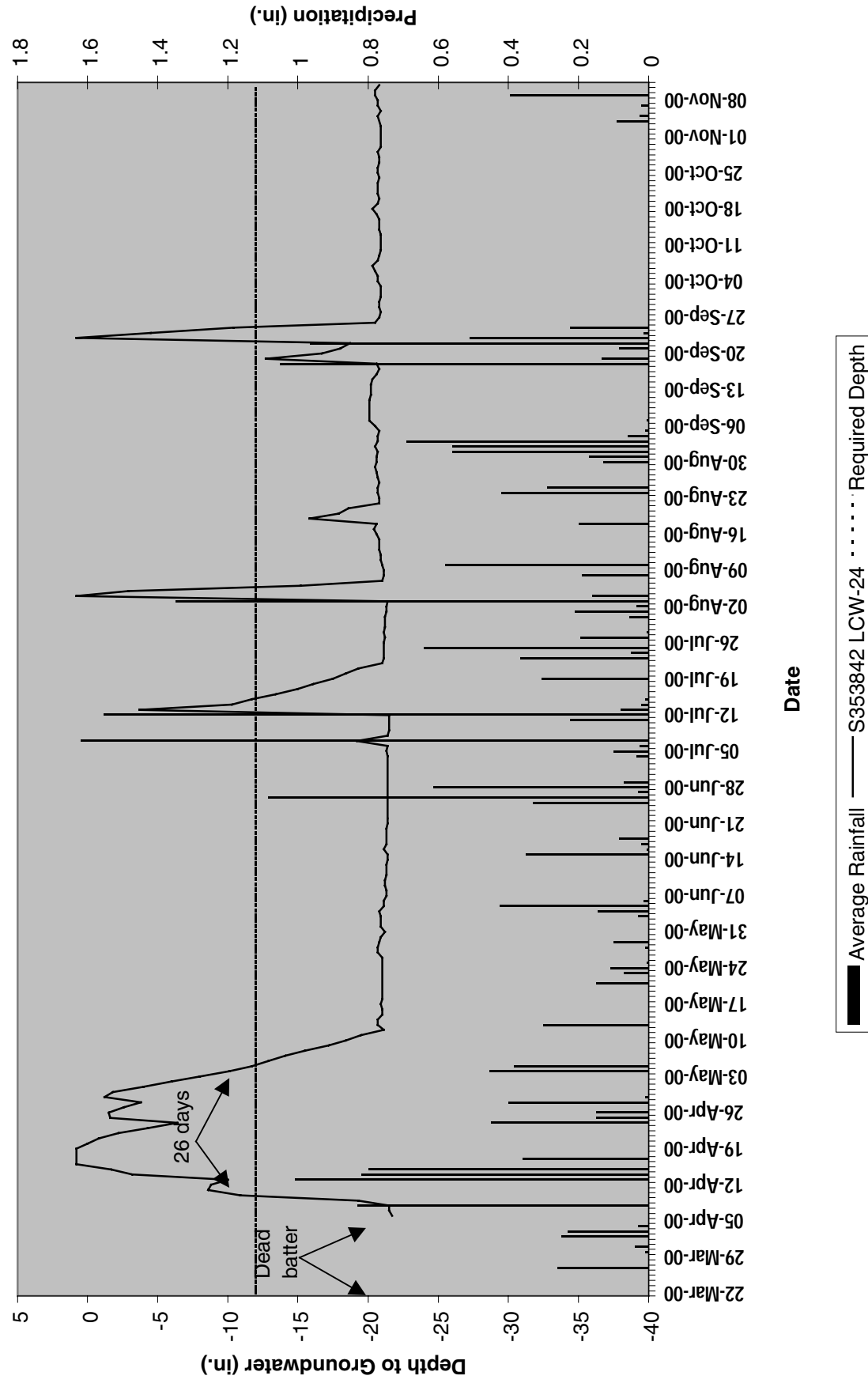
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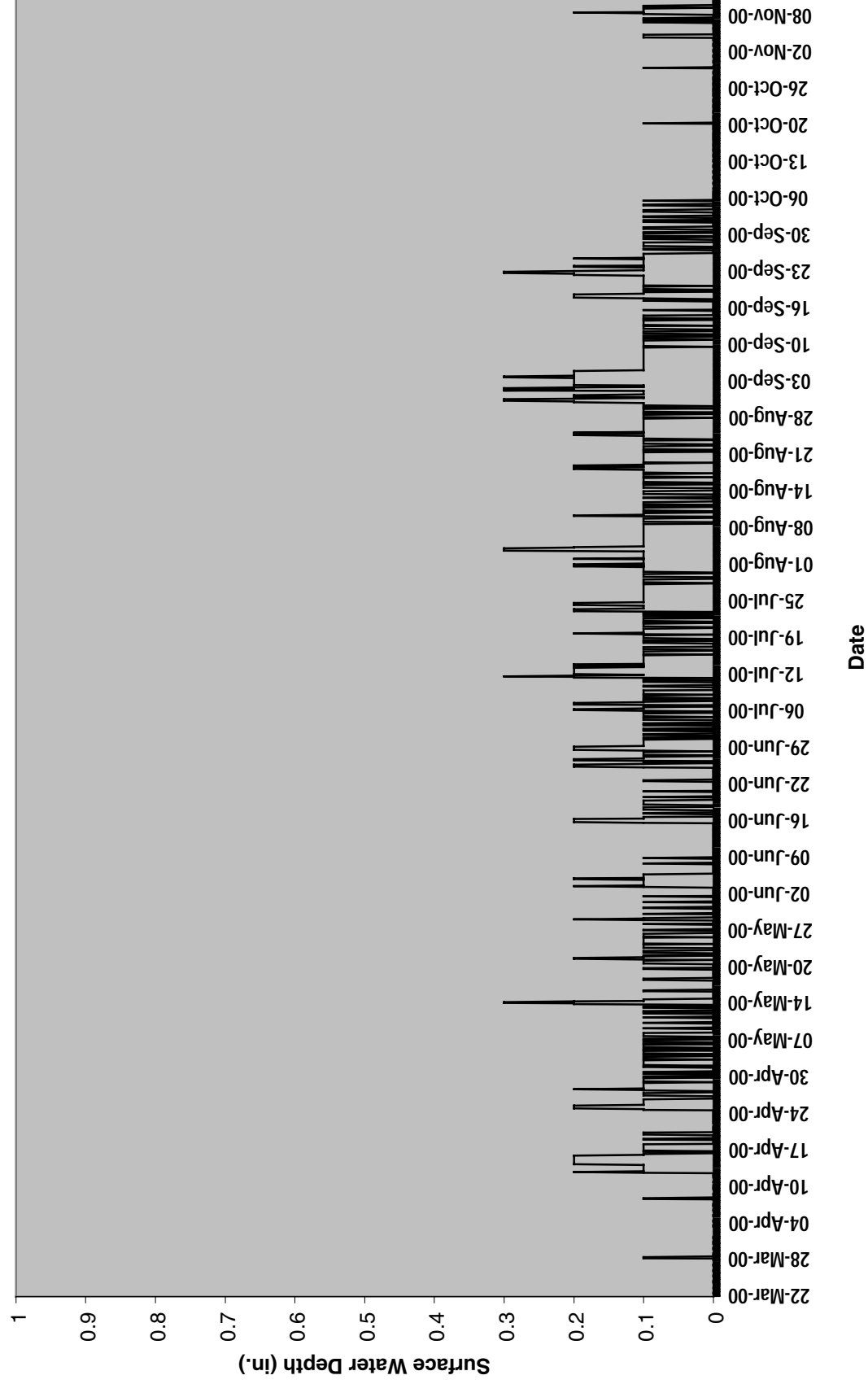
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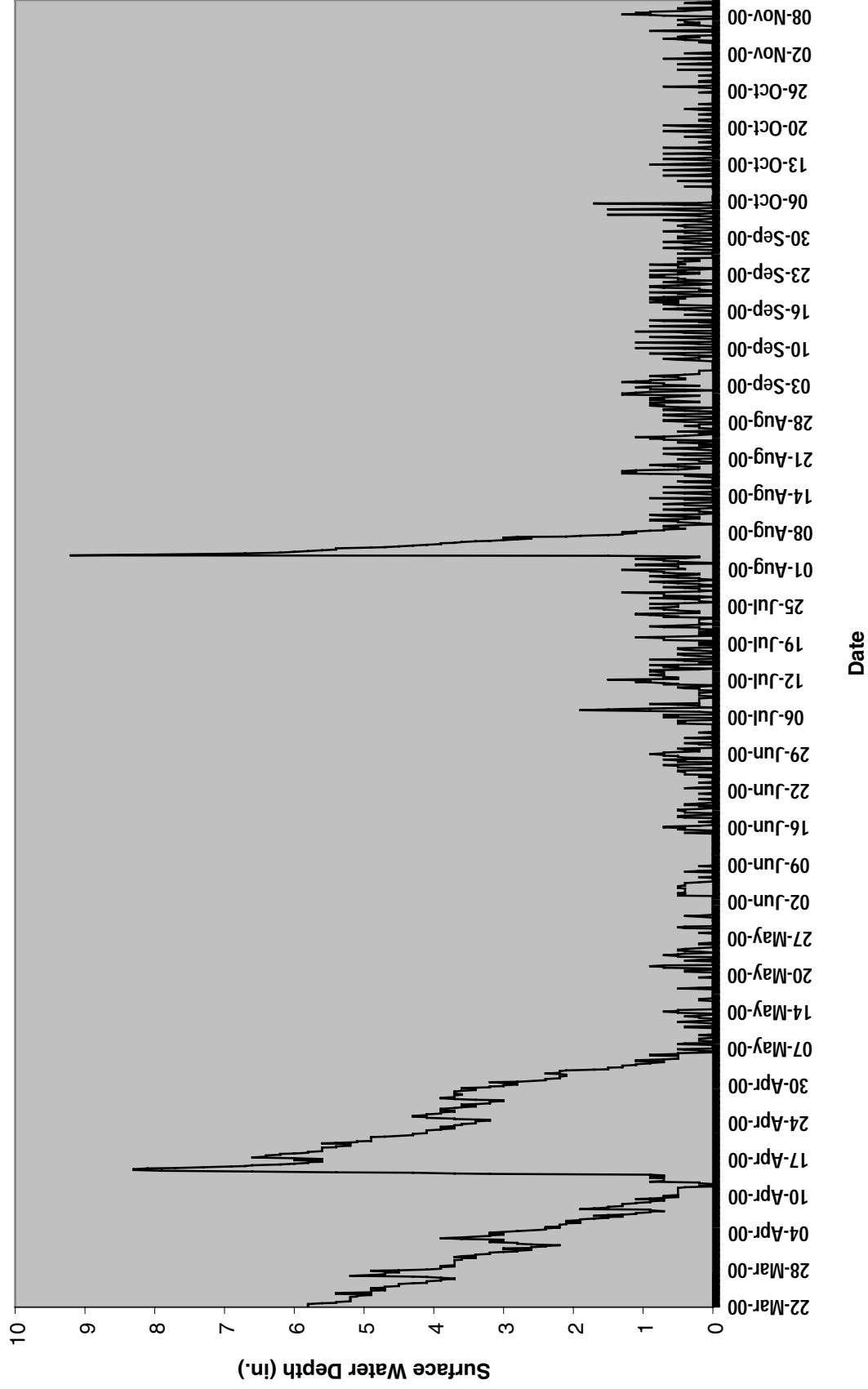
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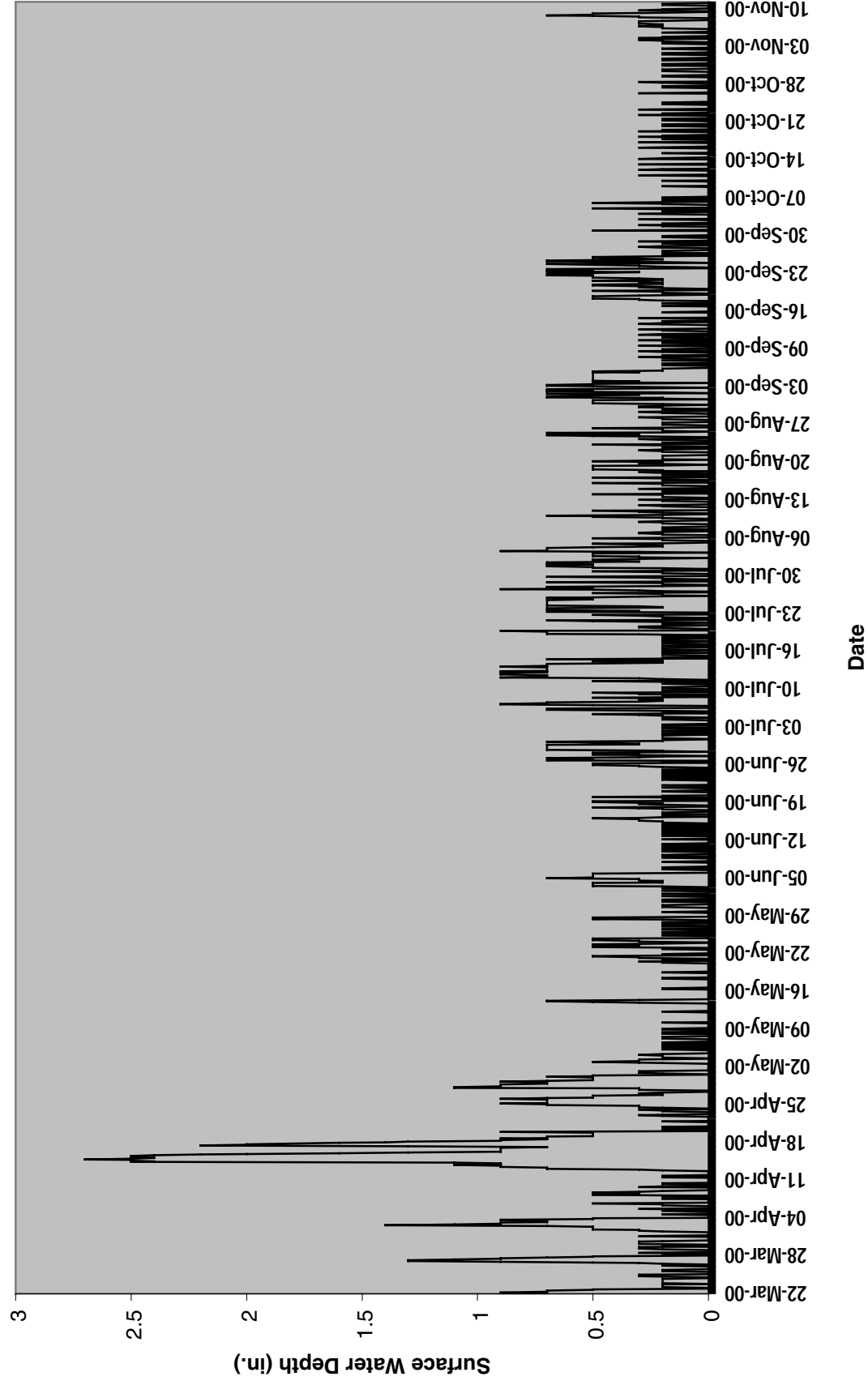
Long Creek LCS-5



Long Creek LCS-8



Long Creek LCS-12



APPENDIX B

SITE PHOTOS



Photo 1



Photo 2



Photo 3



Photo 4



Photo 5



Photo 6



Photo 7



Photo 8

